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Ryan

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(54) **SYSTEM AND METHOD FOR ALARM EXTENSION**

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This patent is subject to a terminal disclaimer.

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Related U.S. Application Data

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G08B 1/08	(2006.01)
G08B 7/06	(2006.01)
G08B 25/00	(2006.01)

(52) **U.S. Cl.**
CPC ***G08B 7/064*** (2013.01); ***G08B 25/009*** (2013.01)

(58) **Field of Classification Search**
CPC G08B 17/00; G08B 25/009; G08B 25/003
USPC 340/506, 534, 628, 632, 13.24, 815.4
See application file for complete search history.

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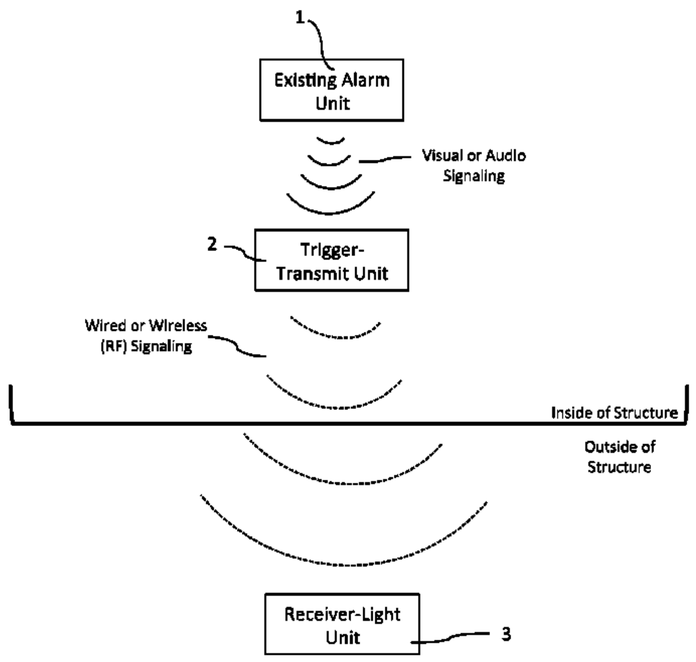
(57) **ABSTRACT**

An alarm extension system that takes an interior alarm condition and extends it to the exterior of a structure. In various embodiments, the present invention is a system and method that links to an existing alarm (smoke detector, burglar alarm, etc.) and activates a flashing mode in one or more exterior lights or an exterior siren. Thus, during an alarm condition within the house or other structure, a neighbor or anyone passing by can become aware of the alarm condition. This method of signaling thus alerts many in the surrounding area of a situation within the building that may require emergency assistance. An alarm indication may also be transmitted over a network to a remote location. The network can be a telephone network and/or the Internet, and the alarm indication can be received by a smartphone or tablet device at the remote location.

16 Claims, 12 Drawing Sheets



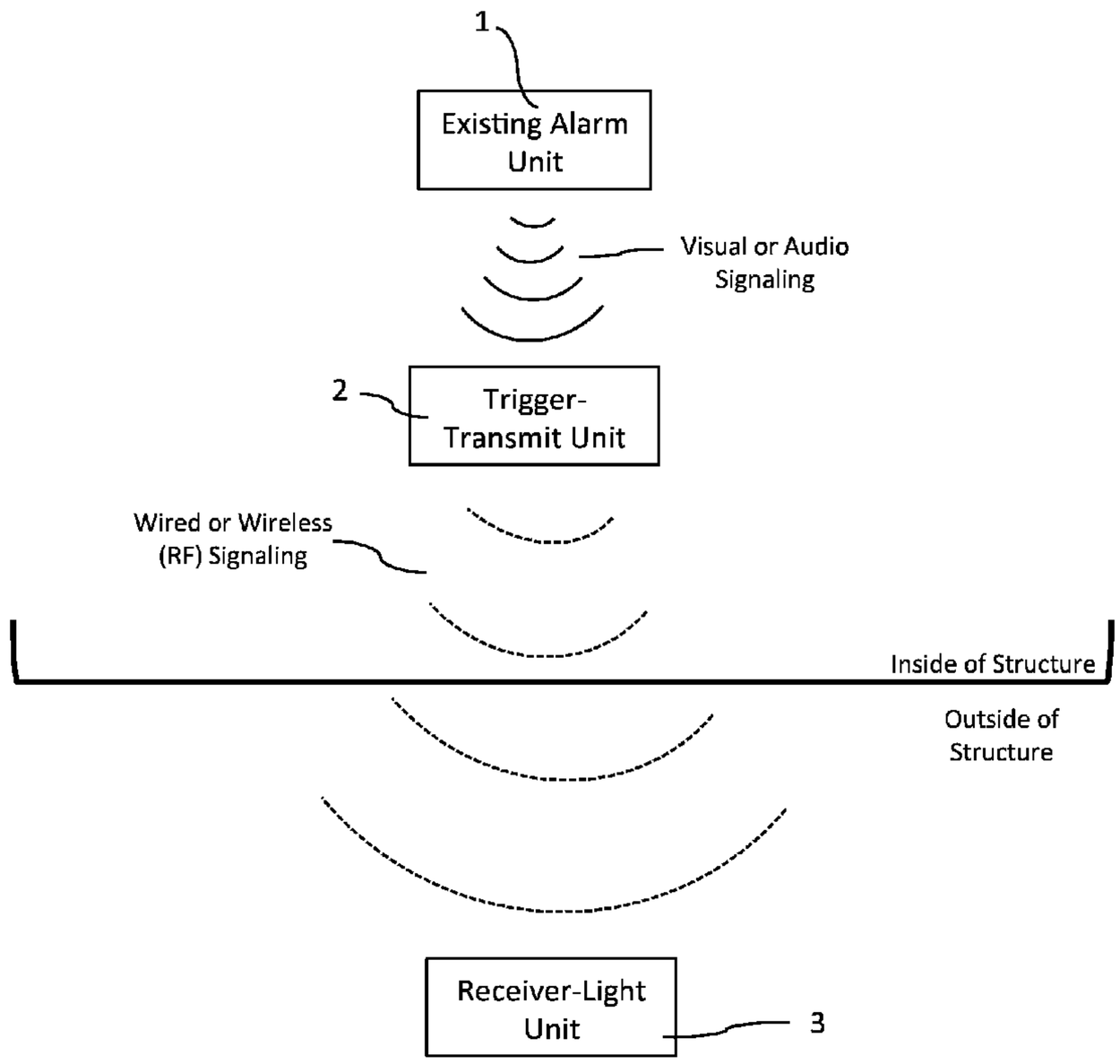

1
Existing Alarm Unit
Visual or Audio Signaling
2
Trigger-Transmit Unit
Wired or Wireless (RF) Signaling
Inside of Structure
Outside of Structure
Receiver-Light Unit
3

FIG. 1

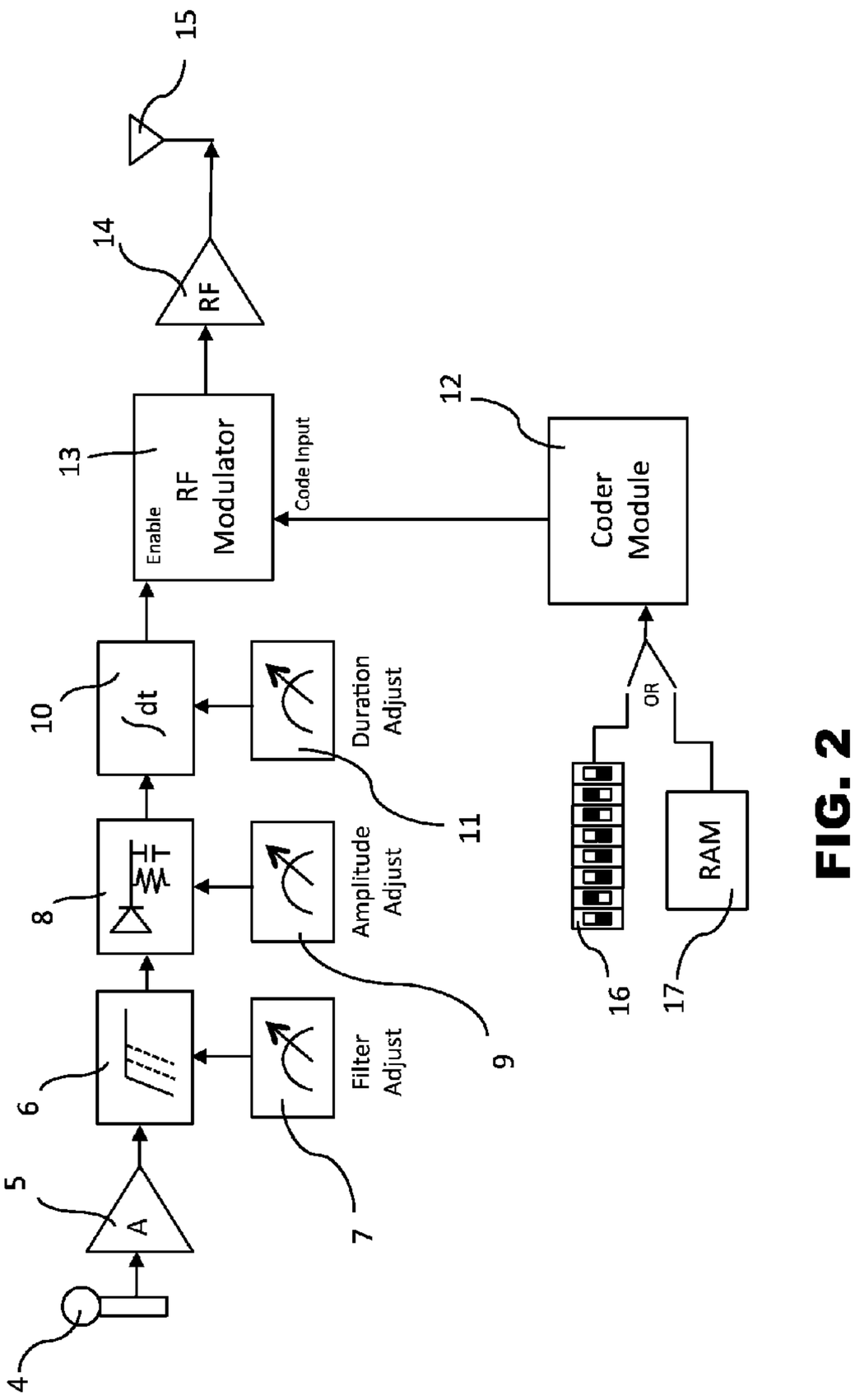

15
14
RF
13
Enable
RF
Modulator
Code Input
12
Coder
Module
10
∫dt
Duration
Adjust
11
8
Amplitude
Adjust
9
6
Filter
Adjust
7
5
A
4
OR
16
RAM
17

FIG. 2

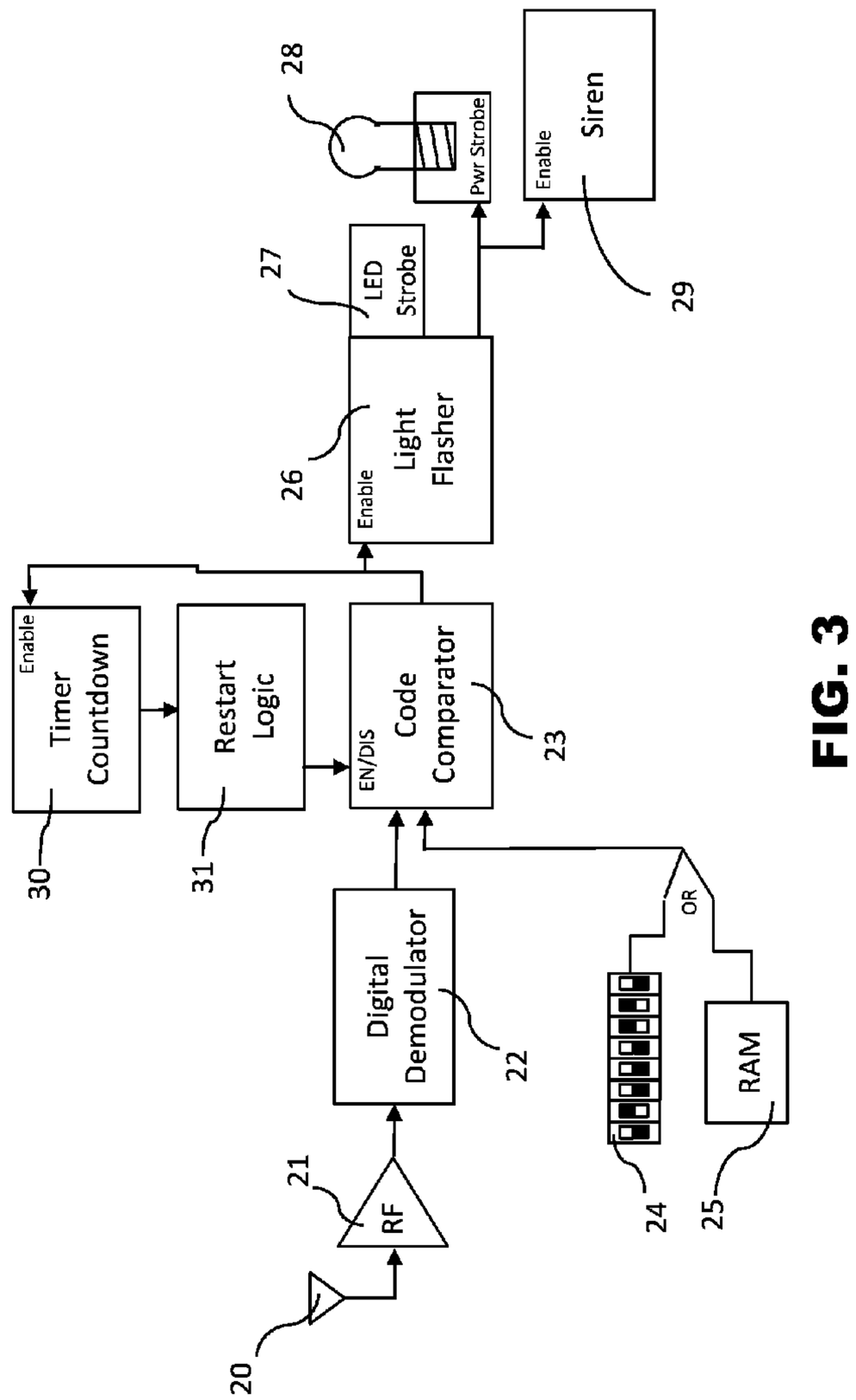

20
RF
21
Digital Demodulator
22
EN/DIS
Code Comparator
23
OR
24
RAM
25
Enable
Timer Countdown
30
Restart Logic
31
Enable
Light Flasher
26
LED Strobe
27
Pwr Strobe
28
Enable
Siren
29

FIG. 3

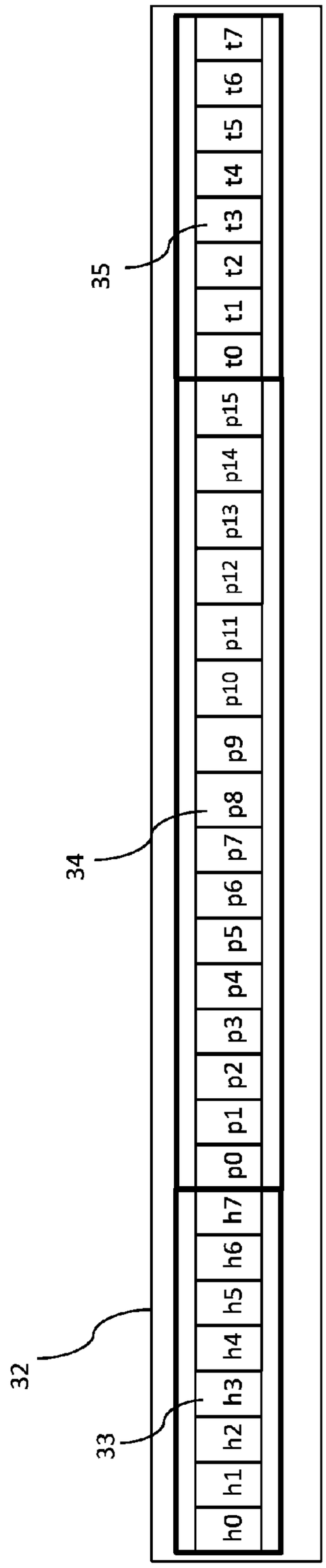

35
34
32
33
t7
t6
t5
t4
t3
t2
t1
t0
p15
p14
p13
p12
p11
p10
p9
p8
p7
p6
p5
p4
p3
p2
p1
p0
h7
h6
h5
h4
h3
h2
h1
h0

FIG. 4

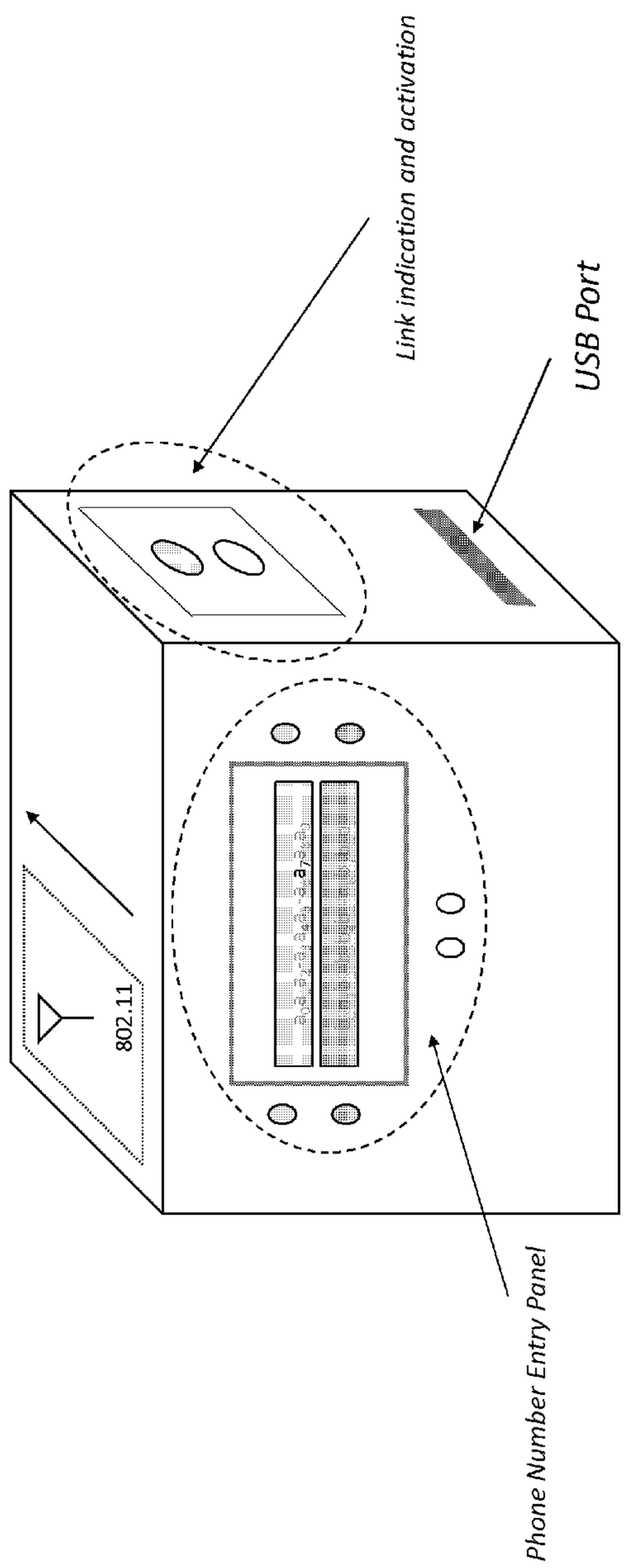

Link indication and activation
USB Port
802.11
Phone Number Entry Panel

Fig 5

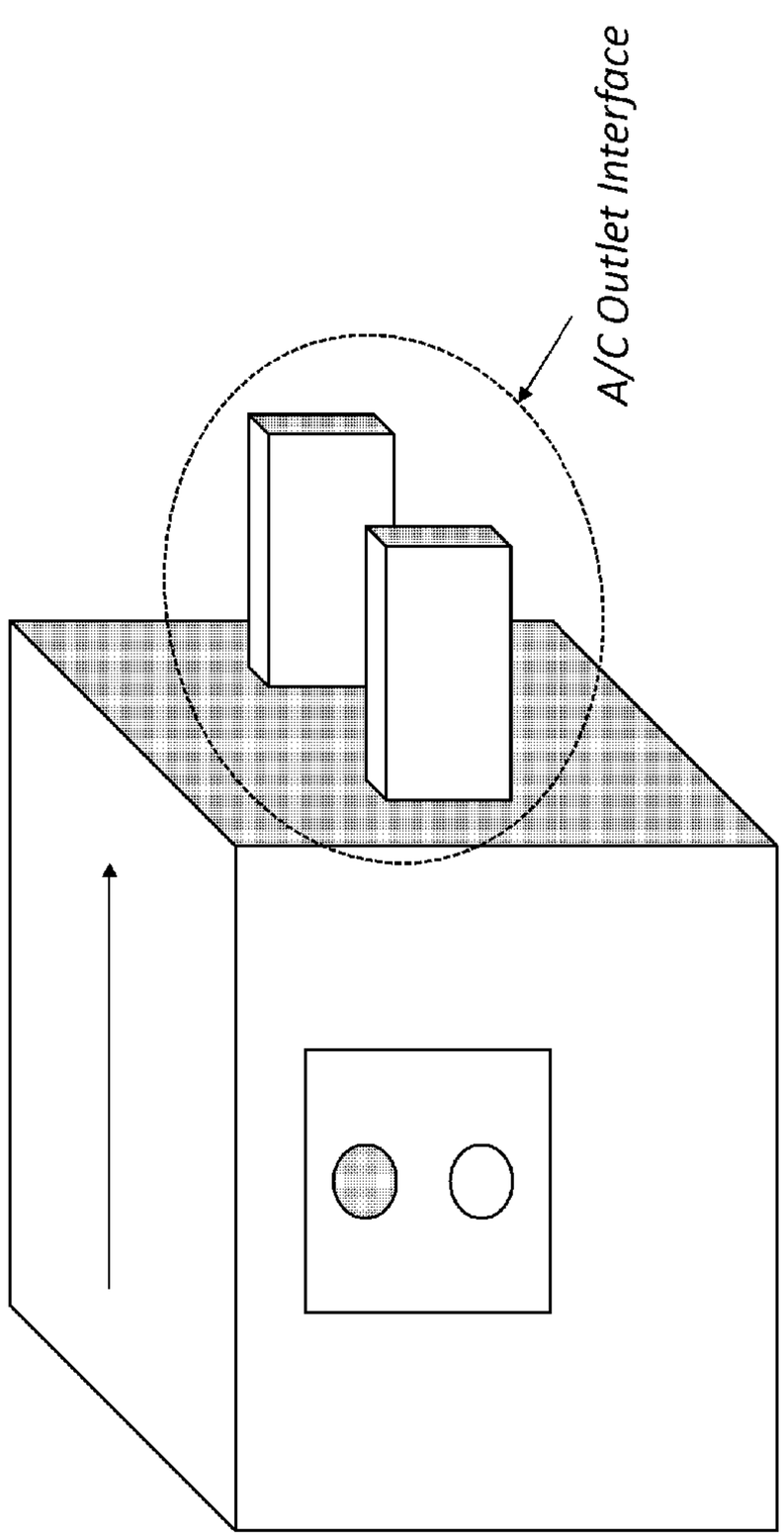


Fig 6

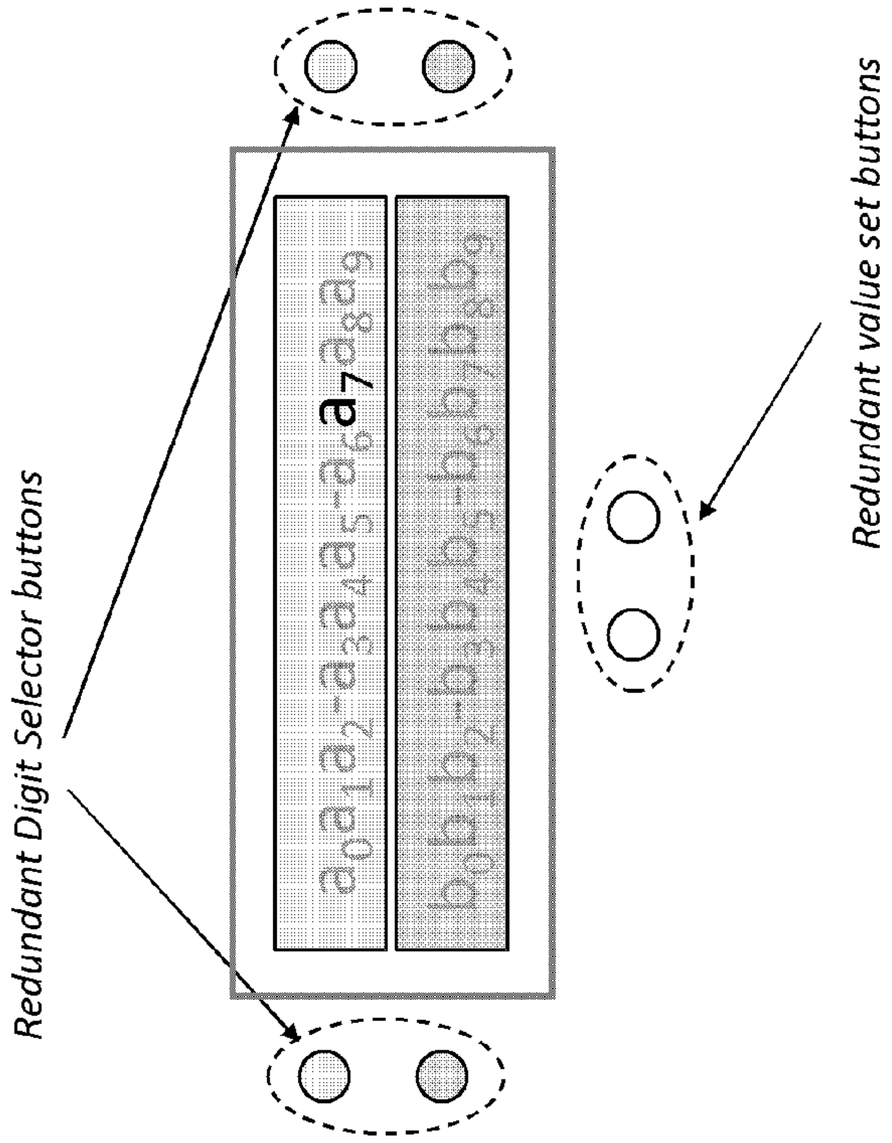

Redundant Digit Selector buttons
Redundant value set buttons

Fig 7

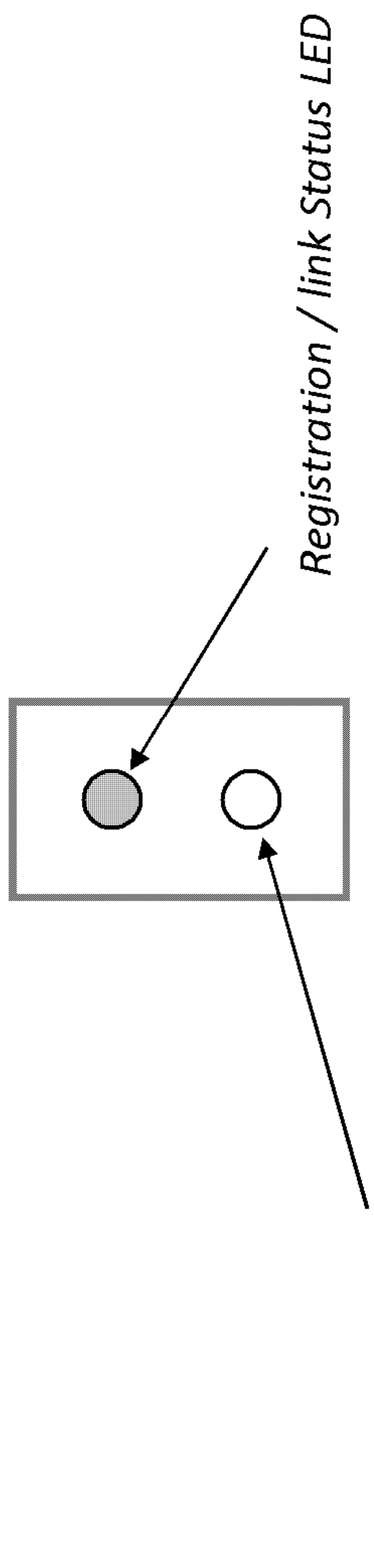

Initialize Registration Button
Registration / link Status LED

Fig 8

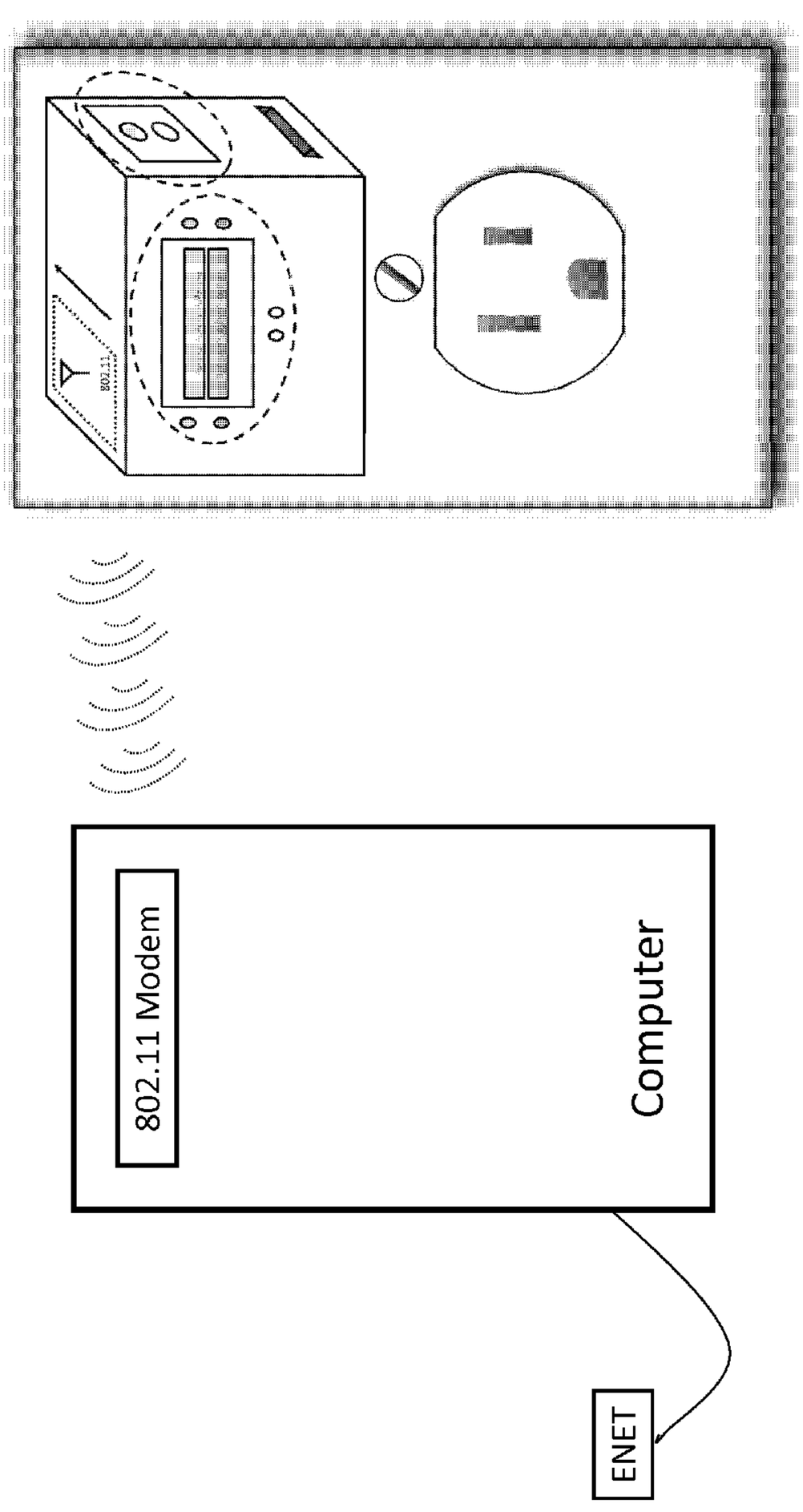


Fig 9

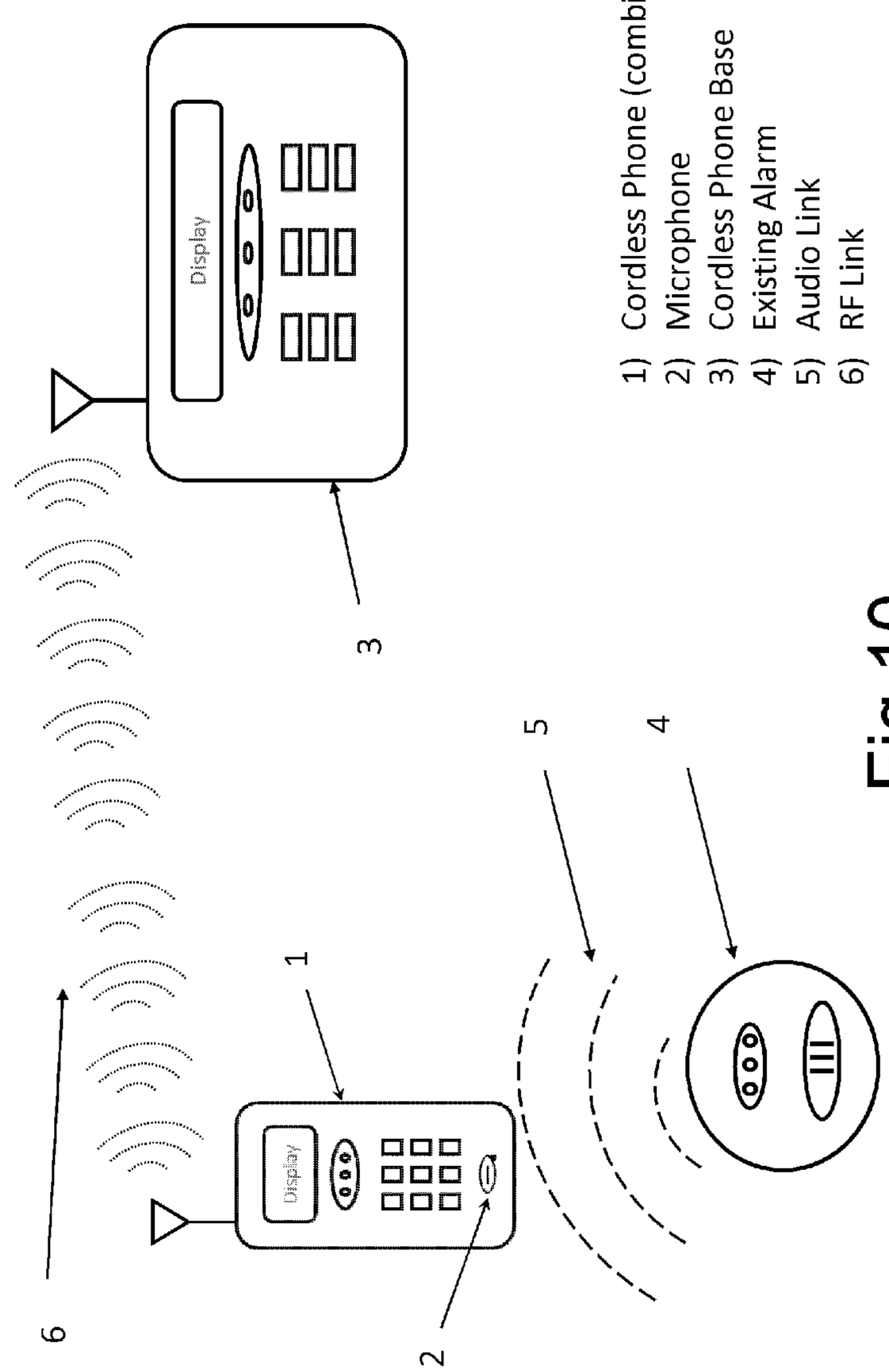

1) Cordless Phone (combined Tx/Rx)
2) Microphone
3) Cordless Phone Base
4) Existing Alarm
5) Audio Link
6) RF Link
Display
Display
1
2
3
4
5
6

Fig 10

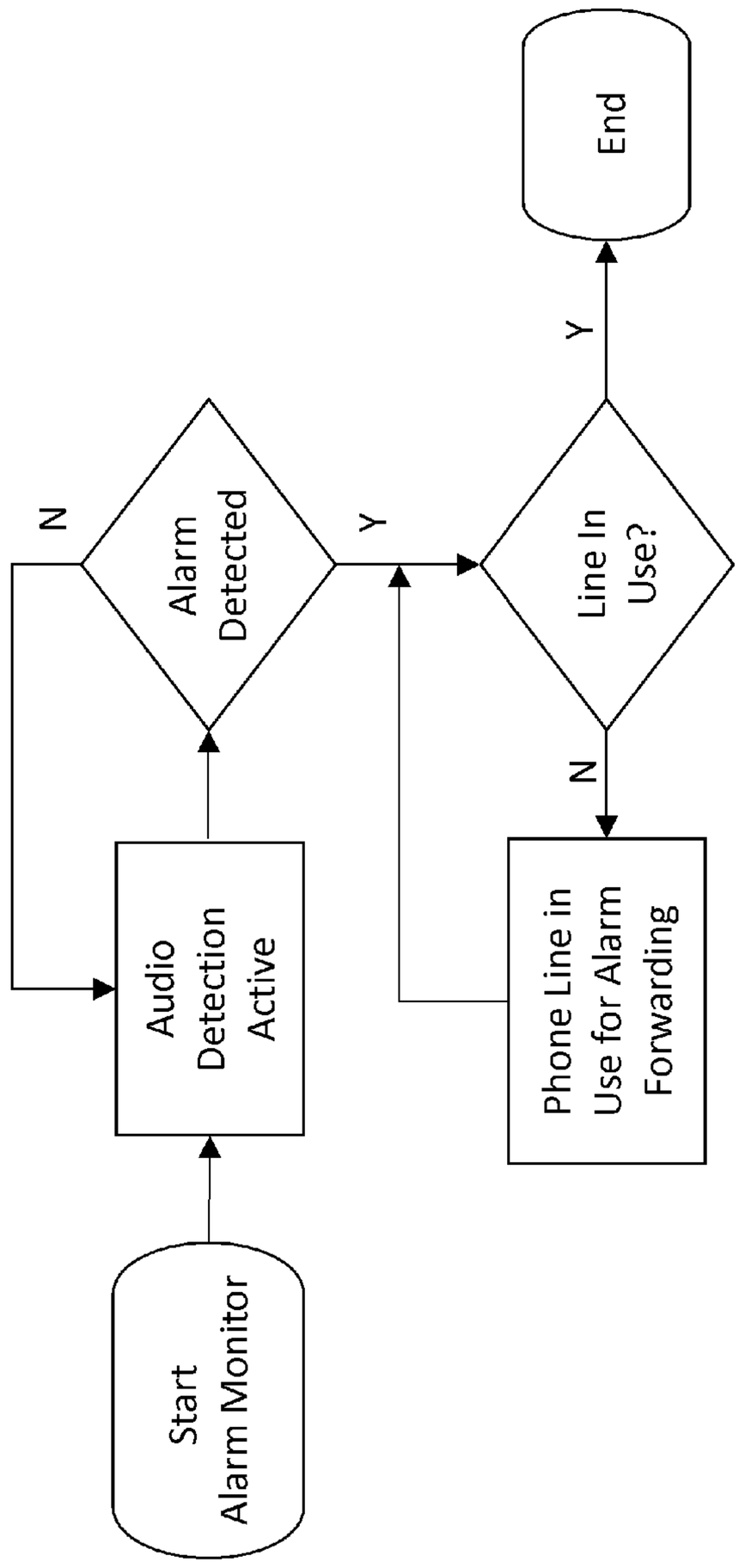

Start
Alarm Monitor
Audio
Detection
Active
Alarm
Detected
N
Y
Line In
Use?
Y
N
Phone Line in
Use for Alarm
Forwarding
End

Fig 11

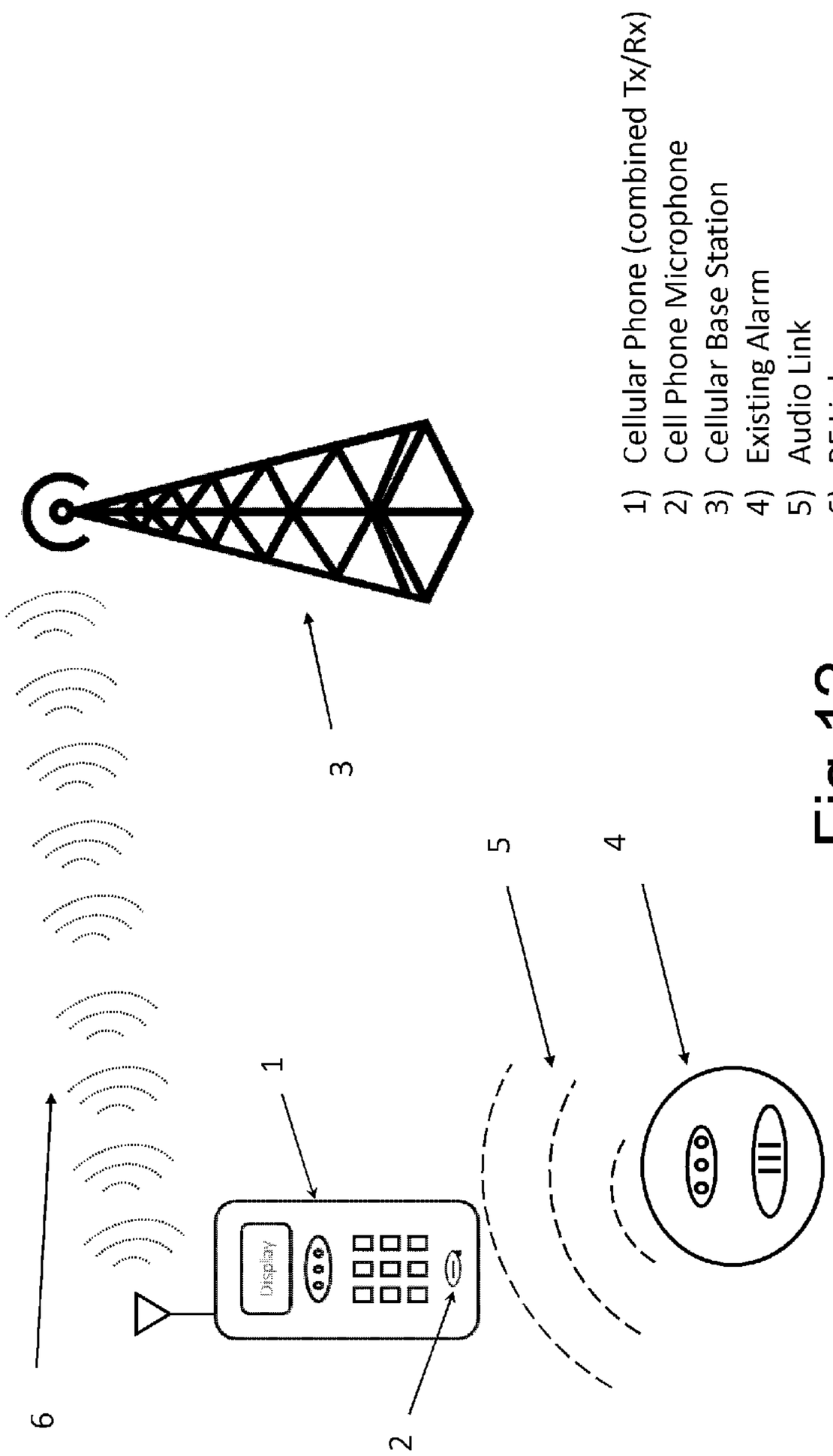

1) Cellular Phone (combined Tx/Rx)
2) Cell Phone Microphone
3) Cellular Base Station
4) Existing Alarm
5) Audio Link
6) RF Link
Display
1
2
3
4
5
6

Fig 12

SYSTEM AND METHOD FOR ALARM EXTENSION

This is a continuation-in-part of application Ser. No. 15/144,110 filed May 2, 2016 which was a continuation of application Ser. No. 14/242,710 filed Apr. 1, 2014, now U.S. Pat. No. 9,330,559 issued May 3, 2016. Application Ser. Nos. 15/144,110 and 14/242,710 are hereby incorporated by reference in their entireties.

BACKGROUND

Field of the Invention

The present invention relates generally to alarm systems and more particularly to a system and method where any activation of an existing alarm system inside a structure can be relayed to an external unit that can flash or provide an audio alert of the internal alarm condition.

Description of the Prior Art

Numerous alarm and emergency indications systems are known in the art. Examples include burglar alarms, smoke detectors, carbon monoxide detectors, natural gas detectors and many other alarms or safety devices.

While some burglar alarms have exterior flashers or sirens, most do not. Most smoke detectors and carbon monoxide or other gas detectors are totally interior. It would be very advantageous to have a device that acted as an extension of an existing alarm device to indicate on the exterior of a structure that there is a problem within.

SUMMARY OF THE INVENTION

The present invention is related to an extension system that takes an interior alarm condition and extends it to the exterior of a structure. In various embodiments, the present invention is a system and method that links to an existing alarm (smoke detector, burglar alarm, etc.) and activates a flashing mode in one or more exterior lights or an exterior siren. Thus, during an alarm condition within the house or other structure, a neighbor or anyone passing by can become aware of the alarm condition. This signaling alerts people in the surrounding area of a situation within the building that may require emergency assistance.

The preferred embodiment includes two units, an alarm detection or trigger unit, and a remote receiver light unit. The trigger unit detects an alarm by sensing an audio signal, a light signal or any other signal from the existing alarm. Typically, the trigger unit is not directly coupled to the alarm. Warranties and contracts on many burglar alarm systems prohibit direct connection. Smoke alarms are generally test laboratory approved and also cannot be tapped into. The trigger unit therefore picks up a light signal or an audio alarm from the interior alarm unit. Upon detection of an alarm condition, the trigger unit sends a coded signal to the remote receiver. This is done using a wireless technique such as RF. The remote receiver is normally located on the exterior of the structure; however, it can also be located in a window or other convenient place where it can signal to the outside world. Upon receiving the correct coded signal, the receiver unit activates and causes lights to flash along with an optional audio signal.

DESCRIPTION OF THE FIGURES

Attention is now directed to several drawings that illustrate features of the present invention.

FIG. **1** is a block diagram of the preferred embodiment.

FIG. **2** shows block diagram of the trigger unit.

FIG. **3** shows a block diagram of the receiver unit.

FIG. **4** shows a possible coded message format.

FIG. **5** shows an alternate embodiment designed to be plugged into a standard power outlet.

FIG. **6** shows a side view of the embodiment of FIG. **5**.

FIG. **7** shows a close up view of a telephone number entry panel.

FIG. **8** shows a close up view of a unit registration interface.

FIG. **9** shows a plug-in unit in communication with a computer or wireless modem.

FIG. **10** shows a cordless phone embodiment of the present invention.

FIG. **11** shows a flowchart of a lockout algorithm.

FIG. **12** shows a cellular telephone embodiment of the present invention. Several illustrations have been provided to aid in understanding the present invention. The scope of the present invention is not limited to what is shown in the figures.

DETAILED DESCRIPTION OF THE INVENTION

The present invention relates to a system for extending an internal alarm from inside a structure to the outside so that neighbors or passersby become aware of a problem inside the structure.

The system includes at least two units: 1) an alarm detection trigger unit, and 2) a remote receiver and annunciator unit. FIG. **1** shows a block diagram of the preferred embodiment. An existing alarm **1** such as a smoke alarm puts out either a visual or audio signal when it detects a dangerous condition. The trigger unit **2** of the present invention detects this alarm. In the case of a smoke alarm, this can be accomplished using a miniature microphone. Electronic circuits can filter and measure amplitude of detected sound to prevent false alarms. The trigger unit **2** can signal wirelessly to a receiver unit **3** typically located on the exterior of the structure. This unit can flash or produce an external audio signal when the trigger unit has detected an alarm. A photocell or other photo detector can be used on the trigger unit **2** to detect flashing alarm lights.

Trigger-Transmit Unit (T-Tx Unit)

There can be any number of embodiments of the trigger unit **2**. At a minimum, the unit needs power (A/C and/or battery), a method to detect an external alarm condition, and a code transmitter. If a/c powered, a battery backup can be used. The unit can also include a rechargeable battery.

The trigger unit may be located right next to, or at least near, the alarm source. For instance, in the case of an extension to a smoke alarm, the trigger unit case can be attached to the ceiling very near the smoke detector. In fact, the trigger unit can even be secured to the smoke detector itself through the use of a clamp. The trigger unit can optionally secure to an existing light socket by having a male light socket adapter as its securing mechanism.

If the alarm is an audible type, an audio detection method is used for the trigger unit. The audio detection electronics can have a simple amplitude range setting that ignores lower level sound thresholds so that the user is less likely to accidentally set off the alarm.

In addition, the audio detection system could implement a time integration of the received audio input. The method of time integration could be either a simple analog type or a digital type. The analog type could employ a very simple op amp integrator and comparator. For digital integration,

detected audio signals exceeding the predetermined amplitude threshold would cause a timer to initiate. The received audio can then be analyzed over the specified time window to determine the amount of time, as a percentage, as having the amplitude threshold exceeded. An alarm condition can thus be required to satisfy the amplitude threshold over a prescribed percentage of any received time span. This would then allow for the filtering (and thus ignoring) of any high level noise of short duration (e.g. a barking dog).

A more sophisticated trigger detection method can implement the use of an audio training mode, which could be used to "learn" the alarm signal. This signal can be stored within the unit and used as a match for the incoming audio activation. This method could provide enhanced trigger detection while limiting spurious alarm activation. Also, simple filtering can be used to eliminate lower frequencies such as voices, bumps, footsteps and the like. Optionally, the trigger unit can be wired directly to an alarm activation lead (used to tie all of the alarms in the dwelling together) or directly to a particular alarm.

The trigger unit can have a unique activation code that can be set by the user or set at the factory. This activation code set on the trigger unit would need to be matched to the code set within the receiver light unit. The activation code can range from a simple sequence of coded numbers from a switch to an advanced rolling code such as that used in some garage door openers. The code can be modulated onto an RF or light carrier or transmitted over power lines using pulse width, pulse amplitude, pulse position modulation, phase modulation or any other modulation technique. In particular, the code can be binary, ternary or based on any other number system. The reason for the activation code is to prevent nearby similar units from different buildings from triggering the receiver unit.

To further enhance the reliability of the trigger mechanism, the present invention can include a redundancy of the trigger hardware. For example, two trigger units can be installed side be side in any one location. This provides **2**N redundancy, and thus far greater reliability.

Trigger-Transmit Unit Input/Output

Trigger-Transmit Unit I/O can include any, all or none of the following:

Audio Alarm.

The Audio Alarm on the T-Tx Unit can indicate any number of conditions such as but not limited to: the triggering of the trigger unit itself, low battery indication, a received alarm condition in any of the alarm extension units, or a tampering condition in any of the alarm extension units.

Unit Disable.

By default, a powered T-Tx unit is on. But occasionally, the user may want to disable the T-Tx Unit. This can be useful during periods of unavoidable noise, such as while vacuuming or when power tools are being used. The audio detection disable can be an on/off button or a button that activates a disable timer. The disable timer causes a temporary disabling of the trigger unit; thus eliminating the possibility of a user forgetting to turn the trigger unit back on.

Alarm Amplitude Threshold Setting.

This feature sets the audio amplitude sensitivity of the T-Tx Unit. This can be either a knob or a push button type. The push button type can walk the audio amplitude trigger sensitivity though a set of discrete levels.

Alarm Duration Threshold Setting.

This feature sets the required duration, or time occupancy threshold, of the audio trigger. This can be either a knob or a push button type. The push button type walks the audio duration requirement though a set of discrete levels.

Alarm Pitch/Frequency Cutoff Setting.

This feature sets the pitch, or frequency cutoff of the audio trigger. This can be either a knob or a push button type. The push button type walks the audio pitch/frequency cutoff setting though a set of discrete levels.

Alarm Learn Button.

The Alarm Learn button can be used to put the unit in an optional Alarm Learning Mode. The user first causes the existing alarm unit (smoke, CO or other installed detector), to activate perhaps via the test button on the existing alarm. Once the existing alarm is sounding, the user then presses the Alarm Learn Button to activate learning. It can be required that the Alarm Learn Button be held for a learning duration, that the Alarm Learn Button be pressed once to start learning, and a second time to stop learning. Any sequence of button interaction can be used to initiate, sustain and disengage the Alarm Learn Mode.

Tamper Proof Mode Engage Button.

The Tamper Proof Mode Engage Button causes the Trigger-Transmit Unit to send a coded transmission to the Receiver-Light Unit to engage the tamper proof mode within the Receiver-Light Unit. The tamper proof mode is typically engaged only after a test has been run to ensure that the Trigger-Transmit Unit and the Receiver-Light Unit are functioning as a pair.

Factory Reset Button.

The Factory Reset Button returns all of the device settings back to the factory default mode.

Shared LED Bank/Numeric User Setting and Mode Indication.

The Shared LED Bank/Numeric User Setting Indicator can be used to indicate the level of any particular user setting. As the user is setting a particular control attribute, the number of LEDs illuminated can increase or decrease based upon the setting. The LED Bank can start to flash once the desired device setting is activated (via the control knob, control button or other). Once flashing, the user knows that the parameter control setting is active. As the knob is turned, or the increase/decrease button is depressed, additional LEDs illuminate or turn off to indicate the setting. If a numeric indicator is used, the current setting number can be adjusted in a like manner.

In addition, the Shared LED Bank/Numeric Indicator can be used to indicate the mode of operation, a successful reception of a "Learned Alarm" or can provide for any number of diagnostic indications, such as but not limited to, normal operation, low battery indication or tamper mode detection.

Ethernet Interface.

The T-Tx Unit can have a wired (E-Net, Fiber etc.) or wireless (cellular, 802.11, etc.) Internet connection.

Generic Electronic Interface.

The T-Tx Unit can have any form of electronic interface such as RS-232, USB, FireWire, IR, and the like. Such an interface is useful to upgrade or configure the unit, or to download any diagnostic or alarm data stored within the unit.

Additional I/O.

Any other T-Tx Unit interfaces not specifically mentioned herein, but required to accomplish any function covered in the body of this document are within the scope of the present invention.

FIG. **2** shows a block diagram of an example embodiment of a trigger unit. A microphone **4**, feeds an audio amplifier **5** that drives an audio filter **6**. The audio filter **6** can be a highpass or bandpass filter that is designed according to

methods known in the art to only detect the desired frequency (pitch) of an audio alarm such as that from a smoke alarm. The audio filter **6** is optionally configured by frequency setting adjust **7**. An amplitude detector **8** sets a threshold on amplitude optionally configured by amplitude setting adjust **9** so that only very loud signals pass. Time integrator **10** can further eliminate audio signals that do not satisfy the time duration requirement configured by the duration setting adjust **11**. A transmit coder module **12** creates the digital activation code and feeds it sequentially to the RF modulator **13**. The RF modulator **13** modulates the code on a wireless carrier in a non-licensed user RF band and feeds it to a power amplifier **14** which drives an antenna **15**. Alternatively, wireless transmission by light can be used. Typically the transmit coder keeps repeating the code as long as the alarm is detected; however, it can be designed to only repeat a fixed number of times. The digital activation code can be optionally selected using switches **16** or stored in a memory **17**.

The embodiment shown in FIG. **2** is mostly analog using well-known op-amps or the like for the audio amplifier **5**, the filter **6** and the amplitude detector **8**. However, as is well-known in the art, an ND converter may be used followed by more sophisticated digital filtering or digital signal processing. This processing can be optionally performed using a digital signal processor DSP chip known in the art. This more sophisticated processing can be used for units with leaning modes and the like. Any type of analog or digital processing or any combination of analog and digital circuitry is within the scope of the present invention. While the example of FIG. **2** uses filtering, amplitude and duration thresholding, any conditioning type may be used alone. The example of FIG. **2** detects audio. As has been discussed, a trigger unit can also be made to detect a flashing light or any other alarm signal.

Receiver-Light Unit (Rx-L Unit)

There can also be a number of embodiments of the receiver light unit. At a minimum, the unit needs power (a/c and or battery), a light, LED or a fixture for a light, and a code receiver. Additionally, if the unit is mounted outdoors, it needs some protection or weatherproofing.

The receiver light unit can optionally secure to an existing light socket by having a male light socket adapter as its securing mechanism. The receiver light unit can simply be screwed into the fixture. The receiver light unit can then optionally have it's own socket into which a standard type of a light bulb or CFL could be secured. If a/c powered, a battery backup can be used. The unit can also include a rechargeable battery.

The receiver light unit may also just be a stand alone unit that is only battery powered. With the present availability of high intensity LED lighting, a long lasting battery powered unit can attached to any exterior location. To keep the unit out of reach of those attempting to tamper with the unit, the unit can be attached just outside of a window. LEDs and modern integrated circuits are not heavy, hence, the receiver light unit can be optionally secured to the exterior of the structure with an adhesive bond or strap.

Receiver-Light Unit Input/Output

The Receiver-Light Unit I/O can include any, all or none of the following:

Audio Alarm.

The Audio Alarm on the Rx-L Unit can indicate any number of things such as but not limited to: a triggered alarm, low battery indication, or a tampering condition.

Unit Disable.

By default, the Rx-L unit is on. But occasionally, the user may want to disable the Rx-L Unit. This can be useful during a power outage or when the alarm extension system is being configured. The Rx-L Unit disable can be an on/off button or a button that activates a disable timer. The disable timer causes a temporary disabling of the trigger unit; thus eliminating the possibility of a user forgetting to turn the trigger unit back on.

Ethernet Interface.

The Rx-L Unit can have a wired (E-Net, Fiber etc.) or wireless (cellular, 802.11, etc.) Internet connection.

Generic Electronic Interface.

The Rx-L Unit can have any form of electronic interface such as RS-232, USB, FireWire, IR, and the like. Such an interface is useful to upgrade or configure the unit, or to download any diagnostic or alarm capture data stored within the unit.

Additional I/O.

Any other Rx-L Unit interfaces not specifically mentioned herein, but required to accomplish any function covered in the body of this document is within the scope of the present invention.

FIG. **3** shows a block diagram of an example embodiment of a receiver light unit. A receive antenna **20** feeds an RF amplifier **21** that drives a digital demodulator **22**. The digital demodulator **22** recovers the digital activation code, which was modulated onto the RF carrier by the trigger unit. A code comparator module **23** compares the received activation code with a stored version of the code to determine an activation. The stored version can be stored on switches **24** or in an optional memory **25** as is known in the art. Upon activation, a light flasher module **26** causes a set of LED lights **27** or other lights **28** to flash, and optionally an audio source **29** such as a siren to activate. One method of operating the receiver light unit is to flash as long as the activation code is continuously received from the trigger unit. A second method is to only operate for a particular timed duration. After a timeout, a check could be made to see if the activation code was still being received. If so, another timed interval can be started. In this case, an optional timer **30** and logic circuit **31** can be used.

The receiver light unit has the ability to receive the activation code sent from the trigger unit. As stated, the path for transmission can be an RF link, over power lines, by light path (possibly infrared) or by any other method used to link a transmitter to a receiver. FIG. **4** shows a sample activation code "packet" that can be sent from the trigger unit. The packet **32** can have a header **33** used to synchronize the digital demodulator **22** and the code comparator **23**. The header can consist of a repeating number of fixed digits or fixed pulses from the RF unit. After the header **33** is the payload **34** that contains the activation code. To avoid transmission errors, the payload **34** can optionally be repeated several times in the packet such as three times. The code comparator **23** can be programmed to accept any good code that comes in, or be required to receive at least two out of three good codes or the like to improve noise performance if the remote unit is located far from the trigger unit. Finally, the packet can have an optional trailer **35**. This can be a series of digits that signal the end of the packet and allow both the transmitter and receiver to shut down.

Additional Components

Panic Button

One or more "panic buttons" can be placed within the housing. The panic button can be a manually operated trigger unit. In the event that the individual is under duress, that person can manually activate the panic button which in

turn sends the alarm activation to the receiver light unit. In addition, a user can keep a panic button on their person. Thus in a situation where there is a medical or other type emergency, the person under duress could access the trigger transmit unit. The panic button could be in the form of a dongle that is worn or otherwise. It can be a trigger transmitter unit itself, or it can communicate with a trigger transmitter unit via a second wireless link.

Security

The trigger transmit unit transmits a unique code to the receiver light unit. As discussed, this prevents activation of an alarm mode by another, closely located trigger transmit unit or by a stray RF or light signal. The code can be made highly secure if desired using encryption such as rolling encryption algorithms used in some garage door openers. However, for typical use in a house, an unencrypted code is usually sufficient. The activation code encrypted or not can roll as is known in the art, or simply be a fixed set of digits.

Tamper Proofing

There can be a mode that is only initiated by the trigger transmit unit where the receiver light unit, once securely in place, is put into a tamper proof state. If a tamper condition is detected, a high intensity audible alarm can be activated within the receiver light unit. The receiver light unit can also send a tamper notification back to the trigger transmit unit. This serves to call attention to the attempted interruption in the system. Such tamper detection within the receiver light unit can be accomplished in a number of ways. An accelerometer can be engaged by the trigger transmit unit, or the unit can be sealed with one or more tamper switches. Alternatively, the tamper mode could detect an a/c power loss. Any a/c power interruption by the trigger unit can be sent to the receiver light unit thereby disabling the a/c tamper mode during an a/c power failure.

Control of Pre-Existing Lights

Typically, a flashing light on the Receiver-Light indicates an alarm condition. However, the Rx-L Unit often requires control of the static light condition (ON or OFF). In cases where the Receiver Light Unit installs in series with an existing light fixture, it is desired to leave the power to the pre-existing light fixture ON at all times so that the unit is charging and not running off of the battery. For this reason, the light switch to power the light fixture should always be ON. At the same time, control of the pre-existing light is necessary. Many methods may be used to control the "ON/OFF" condition of the pre-existing light fixture while still having the ON/OFF switch remain ON during the steady state condition. One method to control the pre-existing light fixture is employs the use of power toggling. A simple toggling of the ON/OFF switch from ON to OFF and then back to ON (ON→OFF→ON) changes the ON/OFF state of the light. In such an embodiment, any time that the Rx-L Unit looses power momentarily, the power passed to the light toggles from OFF to ON or visa-versa. Of course, multiple ON/OFF transitions can also be used to change the static light condition. Finally, a remote control (IR or RF) or any other means not specified here can be used to control the static light condition on the Rx-L Unit.

Feedback from Rx-L to T-Tx

As mentioned, the T-Tx Unit likely resides within the residence. Therefore, it is beneficial to feedback diagnostic information from the Rx-L Unit installed outside the building to the T-Tx Unit within the building. Thus, individuals within the building can become aware of any important status information regarding the Rx-L Unit. As mentioned, tamper indication can be fed back to the T-Tx Unit. Another example of pertinent feedback pertains to the simple loss of NC power, which occurs if a user inadvertently turns OFF the power to an external light fixture housing a Rx-L unit. In this case, a notification can be sent back from Rx-L to T-Tx perhaps causing a chirp sequence to sound on the alarm located on the T-Tx Unit.

Extension to the Internet

The alarm extension system can include an extension to the Internet. An example of this is shown in FIG. **5**. In this case, any alarm, which is picked up by the Trigger-Transmit Unit, is forwarded, via the T-Tx Unit itself or the Rx-L Unit, to an Internet server. Either the T-Tx Unit or the Rx-L Unit can accomplish the actual connection to the Internet. Either device can have a wired (E-Net, Fiber etc.) or wireless (cellular, 802.11, etc.) Internet connection. As an example, the T-Tx unit can use an 802.11 interface to a wireless router as shown in FIG. **5**. Or, an Rx-L Unit can be placed right next to the physical Internet interface point (router, switch, modem, etc.), and have a wired connection to it.

The system can be configured so that an alarm indication is transmitted over the Internet, or by cellular telephone to a remote handheld unit such as a smartphone or tablet computer or to a remote computer. Software on the remote device could also log any alarm indications including the type of alarm, the date and time, and any other pertinent information. A modified T-Tx unit, a modified R-RL unit, or a stand-alone unit can allow communication with the telephone system by entering a telephone number or communication with the Internet using a wireless WiFi 802.11 or other wireless method. Link activation can be initiated and displayed on lights.

Direct Plug-in Housing

A useful way to mount the Tx or the Rx unit is by plugging it directly into a wall outlet. In this embodiment, the Tx or Rx units can be both physically secured, and powered by the ac power wall outlet, or one or the other can be so secured. While plugged in, the unit can be charging internal batteries that can be used in the event of a power outage. The backup batteries can either be separately installed or part of the unit itself. Outlets are universally available in households to the extent that if an alarm of some kind exists, it exists near enough to an outlet to be sufficient for audio detection (especially useful for the "Tx" Unit). The plug housing can have a number of status indications available as well as a number of user interface buttons and ports. A front view of this embodiment is shown in FIG. **5**, while a side view is shown in FIG. **6**. FIG. **7** shows a close-up view of a telephone number entry panel, and FIG. **8** shows a close-up of the unit registration interface. The telephone number entry panel is used to enter telephone numbers to be called or texted to, while the unit registration interface allows the setup of the wireless interface.

The manual user interface to the direct a/c outlet plug in the unit can incorporate aspects of physical user control and entry methods known in the art. For example, resetting the 802.11 (or Bluetooth or other) RF to Ethernet interface can come at the push and hold of the internet reset button. Users can enter phone numbers for text forwarding via the number activation and entry buttons.

Tx Unit with Direct Internet Link

The Tx unit can also have the ability to connect directly to the internet. This connection could be via a wireless (WiFi (802.11 or other), Bluetooth, or other), or via a direct Ethernet cable. Upon sensing an audio alarm condition, the Tx unit can forward the alarm directly to the internet via an established internet connection.

A man to machine interface is generally necessary to configure the Tx unit for use on the established internet network. The network configuration can be done in the following way:

- The user plugs the internet enabled Tx unit directly into a computer via a USB port, or by other means (such as Bluetooth™ or other).
- The Tx unit detects that a connection to a computer has been made, and the Tx unit automatically opens an application on the computer.
- The operating system typically requires confirmation from the user that the application is safe to run. The user gives that confirmation, at which point, the software (installed from the Tx unit, or downloaded from the internet) executes.
- The program asks the user to properly configure the network link by proceeding through the network set up (applying any required passwords, etc.).
- The program confirms that the network connection has been established, and the user sees that confirmation on the computer screen.
- Once the user sees that the network connection on the Tx unit has been established, the user can disconnect the Tx unit from the computer, and install it into the desired location.

An "Internet Active" LED can then be illuminated on the Tx unit to indicate the internet connection is available. FIG. **9** shows a Tx unit connected to the internet. In this case, the Tx unit is in the form of an ac plug-in. However, any Tx unit can be provided with internet access. In FIG. **9**, the plug-in unit communicates with a computer using WiFi, Zigbee, Bluetooth or other wireless technique, or it communicates directly with a wireless modem that connects to the network via either telephone (DSL and the like) or via cable modem.

Tx Unit with Direct Telephone Landline Link

The Tx unit can also have the ability to connect directly to the phone system by being wired straight into the telephone jack. Upon sensing an audio alarm condition, the Tx unit would initiate a call to a wireline-to-text server. In addition, the Tx unit can send a prerecorded message to a set of telephone numbers. The prerecorded message can be one that comes with the unit or one that is recorded by the user.

Cordless Telephone with Integrated Tx and or Rx Unit

The Tx Unit can also be integrated as part of a cordless telephone system as shown in FIG. **10**. In this case, any cordless phone in the cordless phone system could act as an audio alarm sensor by containing the Tx circuitry. As an alternative, to decrease unit cost, special cordless phones with the ability to detect an audio alarm conditions can be offered separately to the end user. Either way, cordless telephones are well suited for either Tx or Rx unit. Cordless telephones have the full ability to detect audio (using the telephone's microphone) a processor to handle the detection logic, and an RF interface to forward an alarm condition (by contacting the base or other cordless phones).

To implement the Tx function, the cordless telephone needs to have an alarm detect mode. The alarm detect mode can be engaged by the user, or can be a function that is always active. In this mode, the phone would always be listening and able to detect, and forward an alarm. The alarm detect mode requires greater current consumption, and thus it is best to have the phone in the charging cradle during this mode.

Ideally, the user would strategically place the cordless phone charging cradles in close proximity to the previously installed detection units (Smoke, CO, Motion or other). Thus, a robust audio detection method can be employed without draining the battery on the cordless phone.

The phone can also engage a low power alarm detect mode while not in a charger. In this mode, the phone would only be listening during a small percentage of time, and increase the listening percentage should an audio signal of sufficient volume be received.

Upon detection of an alarm condition, the modified cordless phone base can forward the alarm in several ways. For example, it can forward to the local Rx units and/or other cordless phones; it can initiate a landline-to-text server connection; and/or it can send a prerecorded message to a set of telephone numbers. The more sophisticated forwarding algorithms normally take place in the cordless telephone base. This reduces system implementation cost (both hardware and software) and extends the battery life of the cordless phone units. The cordless telephone base can control the activity of the client cordless phones depending upon audio detected in any of the cordless phones, or control the battery level of the cordless phone. For instance, the cordless telephone base can increase sleep intervals in individual phones that are low on battery. The base can increase the audio interval or put the phone into a high audio sensitivity mode if a specific audio pattern is received.

The Rx Unit can also be naturally integrated as part of a cordless phone system. This is because many cordless phones already have an intercom capability, and that intercom function can be modified such that it works for the alarm forwarding mechanism. In this case, the cordless phone with an integrated Tx Unit initiates a cordless phone to cordless phone intercom alert. A special intercom response can be designed, which upon activation, sounds a special alert tone and/or special visual indication. The visual indication can be manifested by displaying a specific alarm text message on the user display of the phone, or by a flashing LED indication. High intensity LEDs are particularly useful for the visual alarm indication.

Telephone Landline Lockout, Rx or Tx Unit

In an emergency, a user must be able to call for help. Hence, the telephone line interface from any Tx or Rx Unit must shut down immediately if the unit detects that there is an attempt being made to use the landline. This landline interruption can come during a call to the landline-to-text server, or while sending a recorded message to other phone lines. Any other user of the shared phone line should be considered of higher priority, and that user's phone should immediately disable (lockout) the Rx Unit or Tx Unit landline interface. The landline lockout mode should be sustained for a predetermined period of time.

It is desirable to periodically check the landline lockout mode. A separate landline lockout test mode can be made available whereby the user can initiate the test (by physical test button or other means), after which, the user would pick up a landline. It is also possible to initiate the test automatically. An Rx or Tx Unit with a landline interface, when under test, should detect the active landline condition, and upon doing so, feed this detection back to the user by activating a visual (LED or other) indicator and/or by sounding an audio alert (the "landline in use" or "landline lockout" indicators). FIG. **11** shows a flow chart of such a lockout. When the audio alarm detector is activated, the system loops in an alarm detection mode. If there is an alarm, the system attempts to forward it via telephone; however, if the landline is in use, the forwarding stops or is prohibited.

Cellular Telephone with Integrated Tx and or Rx Unit

The cellular telephone, like the cordless telephone, has all of the basic attributes needed to be a combined Tx/Rx unit.

An embodiment using a cellular telephone is shown in FIG. **12**. The cellular phone has a microphone for detecting audio, a processor to handle the detection logic, and an RF interface to forward an alarm condition. The cellular telephone communicates over the cellular network and has capabilities well beyond that of a cordless telephone . . . such as the ability to send text messages directly.

Smart phones are commonplace, and it is relatively straight forward to implement a Tx or Rx unit by writing a cell phone application.

Smart phones are somewhat expensive. It may be cost prohibitive to have a smart phone always in one's house or place of business at all times (especially when the user is not there). On the other hand, even a cell phone operating as a Tx/Rx unit only when in the same dwelling as the cell phone's owner can save lives. Most home fire deaths occur by smoke inhalation, and this many times happens at night. The use of a charging smart phone is a relatively inexpensive way to have a neighbor, or a local fire department alerted in the event that an audio alarm is active. A user in a dwelling could be rendered unconscious by smoke, but if others are made aware of the emergency, lives can be saved.

In any case, the use of a cellular telephone or smart phone as a trigger device requires an application that includes of a set of executable instructions (called an App) that can be downloaded into the phone's memory and can execute on its processor. The executable instructions cause the telephone's microphone to listen for an audio alarm from an existing alarm device like a smoke alarm. The processor typically receives digitized audio samples from an analog to digital converter that is part of the telephone. The processor can be programmed to filter ambient sounds according to amplitude, frequency and duration as previously discussed. The processor can then be programmed to recognize a valid alarm condition using the results of the filtering. Upon recognizing a valid audio alarm condition in the ambient audio entering the microphone, the processor can take an affirmative action such as sending a text message to a remote location, placing a cellular telephone call to a remote location or taking other action. The cellular telephone call can optionally contain a pre-recorded or synthesized voice message reporting the alarm. This can include the address and name of the home owner and the like as well as the condition that caused the call.

User Activated System Test

Another useful feature on embodiments of the present invention is a user-activated test system. This is a system test that is Initiated from the Tx unit. When activated, the Tx unit initiates a repeating series of transmit intervals, during which, the properly modulated alarm activation code is sent. The user then goes to each Rx unit to ensure that the proper action is taking place. The proper response for the Rx unit could be on of several responses, such as, but not limited to; an audio/visual alarm, the initiation of a text message sent via the internet, initiation of a text message sent over the phone lines or an internet connection, forwarding a recorded message and the like.

In addition to the confirmation of the proper Rx Unit responses, all of the previously mentioned self-forwarding modes of the Tx unit can also be tested and confirmed during the system test. Although a complete end to end test of the system is the most beneficial, there can also be partial test modes allowing the user to only test an aspect of the complete alarm extension system, such as, but not limited to the Tx unit's ability to detect an audio alarm.
Alarm Cancel Mode, Tx or Rx Unit

Another useful feature of the present invention is Alarm Cancel modes. The Tx/Rx Alarm Cancel Mode cancels an active alarm condition in the Tx or Rx Units. This allows the user to "silence" an existing alarm condition. The Tx/Rx Alarm Cancel Mode can be activated by the user via a physical button, IR signal, RF signal or other means. It is also useful to silence all Rx units at once. This saves the user the effort of walking to each Rx unit in order to silence it. The alarm cancel modes are useful when accidental triggering of the Tx unit occurs, or to cancel a system test. The Tx Alarm Cancel mode can be activated by user via a physical button, IR signal, RF signal or other means.

Low Battery Indication Feedback

There may be applications where some of the Rx or Tx units are located in areas that are remote from where the user is located. This makes it difficult for the user to notice that a low battery indication (audio, visual or other) has been activated. Therefore, it is useful to have the ability to periodically broadcast a low battery signal. The system can be set up such that every unit in the system (both Rx or Tx types) can respond to a low battery signal. The units can be set up to automatically respond to a low battery signal, or have the ability to be put into a user selectable low battery signal reception mode. An alternate embodiment allows only specific units which are capable of responding to a low battery signal. Having a limited number of responding units saves overall system cost.

Several drawings and illustrations have been presented to aid in understanding the present invention. One with skill in the art will realize that numerous changes and variations are possible without departing from the spirit of the invention. Each of these changes and variations is within the scope of the present invention.

I claim:

1. An alarm reporting system comprising:

a trigger unit connected to a telephone system, the trigger-transmit unit adapted to be located in proximity to an existing alarm device, said trigger-transmit unit configured to receive an audio alarm indication from the existing alarm device and transmit an alert message over the telephone system to a remote location;

wherein the trigger-transmit unit filters the audio alarm indication to require a predetermined time duration of the audio alarm indication.

2. The alarm reporting system of claim **1** wherein the telephone system is a landline telephone system.

3. The alarm reporting system of claim **2** wherein the trigger-transmit unit is a cordless telephone.

4. The alarm reporting system of claim **3** wherein the cordless telephone uses one or more remote handsets to receive the audio alarm indication from the existing alarm device by listening for the audio alarm indication and wirelessly forwarding an indication of the audio alarm indication to a cordless telephone base, wherein the cordless telephone base sends the alert message to the remote location.

5. The alarm reporting system of claim **4** wherein the cordless telephone causes remotes handsets that are not cradled to listen for an audio alarm indication for only predetermined listening time intervals to conserve battery power.

6. The alarm reporting system of claim **4** wherein at least one cradled remote handset listens continuously for an audio alarm indication.

7. The alarm system of claim **4** further comprising a lockout feature wherein a user is always allowed to place a standard telephone call using the remote handset.

8. The alarm reporting system of claim 7 wherein the trigger-transmit unit is a cellular telephone.

9. The alarm reporting system of claim 1 wherein the telephone system is a cellular telephone system.

10. An alarm reporting system comprising a set of executable instructions executing on a processor on a cellular telephone, the cellular telephone having a microphone configured by the executable instructions to transmit digitized audio samples of ambient sounds to the processor, the executable instructions configured to cause the processor to recognize a audio alarm indication from an existing alarm device, the executable instructions also configured to cause the processor, upon recognizing said audio alarm condition, to send an alarm alert message over a cellular telephone network to a remote location;

wherein, the executable instructions cause the processor to filter the audio alarm indication to require a predetermined time duration of the audio alarm indication.

11. The alarm reporting system of claim 10 wherein, the executable instructions are configured to cause the processor to send a text message to the remote location upon recognizing said audio alarm condition.

12. The alarm reporting system of claim 10 wherein, the executable instructions are configured to cause the processor to place a cellular telephone call to the remote location upon recognizing said audio alarm condition.

13. The alarm reporting system of claim 12 wherein the cellular telephone call contains a voice message.

14. A system for reporting an alarm from an existing alarm device comprising:

a cordless telephone base attached to a landline telephone system;

at least one cordless handset capable of wireless communication with the telephone base, the handset transmitting replicas of received sounds to the telephone base;

the telephone base constructed to activate the cordless handset to listen to ambient sounds and to recognize a audio alarm condition from the existing alarm device;

the telephone base configured to transmit a alert message over the landline telephone system upon recognizing the audio alarm condition;

wherein, the telephone base determines if the cordless handset is cradled or not, and if cradled, causes the cordless handset to listen continuously for the audio alarm condition, and if not cradled, causes the cordless handset to listen for the audio alarm condition for only predetermined listening time intervals to conserve battery power.

15. The system of claim 14 wherein, the alert message is a recorded or synthesized voice message.

16. The system of claim 14 further comprising a lockout that causes the cordless handset to stop listening for the audio alarm condition when a user initiates a standard telephone call.

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